WESTERN UPDATE #67

THE WESTERN NEWSLETTER FOR MF, LF, AND VLF EXPERIMENTERS

Available for business-size 25 cent SASE's , plus 60 cents per issue (or $7 per year)
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ACTIVE WESTERN BEACON STATUS (LIST COMPILED SEPTEMBER 17, 1989)

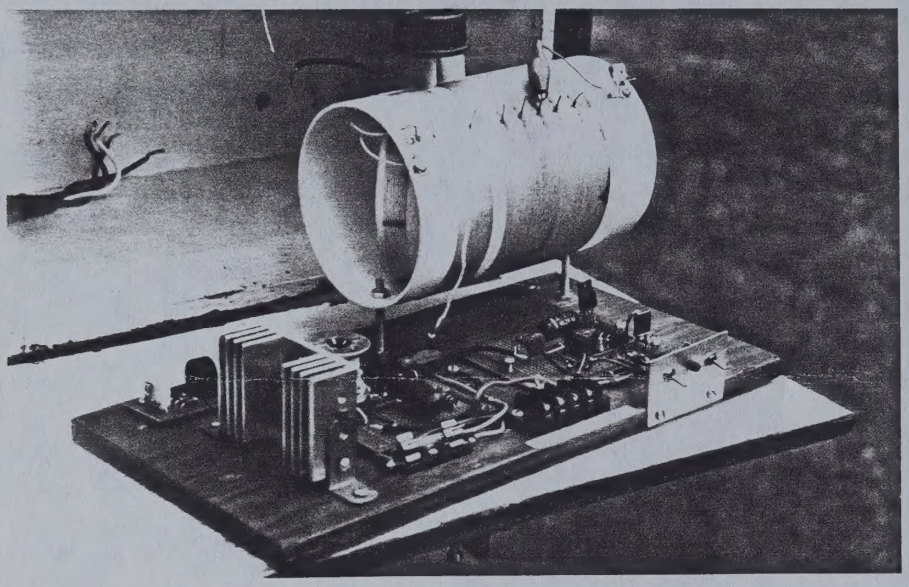
FREQ(kHz)	IDENT	QTH	SKED INFO
163.80	FPV	Granada Hills, CA	Weekends. See alt. freq. 182.62 kHz.
163.88	M	San Diego CA	Intermittent.
166.503	C	near Morro Bay, CA	24h/7d.
169.96	NRE	San Diego, CA	24h/7d
171.145	**K**	**Unknown (SF Area?)**	**Heard by MEL in September**
175.225	MAX	Wheatland, WY	24h/7d CW. BPSK/ASCII by request.
175.703	FAW	Orem, UT	24h/7d.
176.26	CO	Glenwood Springs, CO	24h/7d
176.75	SR	Elgin, OR	Off for awhile
176.85	7FS	Belfair, WA	24h/7d.
177.75	**CT**	**Pleasant Gap, PA**	**10 baud BPSK starting October 15th.**
179.0	MPM	Salt Lake City, UT	24h/7d. ASCII/CW alternating 5minutes.
179.54	WJ	Arleta, CA	Intermittent.
180.224	F	Los Banos, CA	FSK. By request.
180.80	XU	Sioux Falls, SD	24h/7d. BPSK/CW alternating 5 minutes.
181.17	IZJ	San Gabriel, CA	Daily. Silent 0700 to 1100 UTC.
182.62	FPV	Granada Hills, CA	Weekends See alt. freq. 163.80 kHz.
182.672	G	Palo Alto, CA	24h/7d.
182.88	H, H2	Descanso, CA	24h/7d. Alt. Freq = 166.90 kHz.
183.160	PRK	Saratoga, CA	24h/7d.
183.544	**MEL**	**San Jose, CA**	**24h/7d. Note QSY.**
183.63	PLI	Burbank, CA	Unknown.
184.016	EK	Sunnyvale, CA	24h/7d.
184.383	TI	Kingman, AZ	24h/7d.
184.39	HO	Pahoa, HI	By request.
184.43	V	Forestville, CA	24h/7d.
184.46	B	Fresno, CA	24h/7d.
185.0	ZYK	Redway, CA	24h/7d.
185.49	AZ	Tucson, AZ	24h/7d. Alt. Freq. = 187.77 kHz.
186.80	BA	Lancaster, IL	24h/7d.
187.0	ELU	Simi Valley, CA	24h Saturday and Sunday on SSB.
187.252	TEXAS	NW of Ft. Worth, TX	24h/7d.
187.30	UPN	Cincinatti, OH	Occasional.
187.50	DCH	Berlin, MD	Off until September.
187.59	SM	San Jose, CA	24h/7d.
190.4	OHH	Richmond Hill, Canada	Occasional testing.
525.+/-.76	T (dashes)	Sunnyvale, CA	A2 mod 24h/7d.
1588.41	**Z2**	**9 mi NW San Simeon, CA**	**Mideke QSY.**
1619.92	**D**	**Salt Lake City, UT**	**24h/7d morse/FSK. New! Mark Mallory.**
1620.08	**U**	**Salt Lake City, UT**	**24h/7d morse/FSK. New! Mark Mallory.**
1624.75	**CT**	**Pleasant Gap, PA**	**24h/7d. 5 baud CCW. On by Oct. 15th.**
1631.54	A	Cleveland, NC	24h/7d.
1650.67	TI	Kingman, AZ	24h/7d.
1655.5	**CO**	**Glenwood Springs, CO**	**24h/7d.**
1661.35	U	San Diego, CA	Nites only.
1687.28	D	Descanso, CA	6PM to 6AM daily Frank Cathell.
1820.00	**CO**	**Glenwood Springs, CO**	**Nites. New Beacon!**

MORE SASES ON FILE

Non-Western listings are beacons currently being copied in the West, or they have SASE's on file with us. Bold entries indicate recent changes, or new beacons.

EK NOTES: It's been a crazy, busy summer but we finally got **WU#67** put together! The improved print quality is the result of purchasing a new Hewlett Packard Deskwriter inkjet printer. The result speaks for itself. Ain't technology wonderful?

Quite a number of good articles this issue -- Thanks to the contributors, and let's keep the information coming!



MAILBAG: **Dave Holland (DCH)** of Maryland writes that "DCH will be back on the air sometime in September. The photo is of my LowFer xmtr with a Litz loading coil. The little gadget at the upper-left corner is a RF pickup. It converts RF to calibrated DC volts for direct readout. This is from **Frank Cathell**'s skunkworks!"

Thanks to Sunnyvale, CA MedFER **Ed Gelinas** for the drawing and photo of his antenna. Ed had a LowFER beacon on 162 kHz, but a nasty neighbor called the city and they made him take it down! Ed reports, "I'm going to give the antenna to **Bob, KB6QXM.** He is going to install it in the Santa Cruz mountains on 171 kHz."

Frank Cathell (H2, San Diego area) says, "**H2** is still grinding away 24 hours, and **D** is on most nights. The only LowFER signals I hear are **NRE, IZJ, C, and TI.** I have had several QSO's with the Southern California SSB guys using CW with the H2 transmitter this summer. **TI** MedFER still booms in here every night. No other MedFER's present. I'm sure radio experimenting will pick up when the dx season starts."

Keith Olson (7FS, Washington) sent more data on his new LowFER helical. "The helical consists of four ten-foot lengths of 4" PVC #40. Each one is wound with 500 turns of 7/26 Litz wire. All sections are in series. The tophat is six pieces of 3/8" fiberglass rod clamped to 6 pieces of 1/4" fiberglass rod. The rods are covered with shield from some RG11. Each conductor is 132 inches long. This assembly resonates against ground at about 240 kHz, making it necessary to use a little over 1 mH to resonate at 176.85 kHz. Counterpoises are from 8 to 10 feet high, insulated from ground. Ground is about 8 six-foot rods which are used to tie down the mobile home." Keith says that the helical would perform better were the height/diameter ratio more like 20 to 1. Keith comments, "This is probably unreachable for an amateur station, but I think quite an improvement could be made by using 10 or 12 inch grey electricians conduit, strength 80."

Steve McGreevy (NTS) has moved from San Rafael, CA to Hawaii for the winter dx season and says he can be contacted via **Sheldon Remington** in Pahoa (see listing).

Speaking of Hawaii, **Dean Manley** of Hilo writes, "KH6B/B 1809.5 kHz is now off the air due to lightning damage. It had been on since August 1988. There are no present plans to restore its operation. There is, however, interest in building a MedFER beacon." Dean adds, "Since California and other western states are mountainous, beacons with high-angle radiation may be useful at 1600 to 1700 kHz. While most reference sources dismiss skywave daytime at MF due to high absorption, **ON4UN**'s Low-Frequency Handbook states that high-angle radiation penetrates the D layer with little attenuation. With reflection from the E layer, communications should be possible day or night within 50 to 75 mile radius. With a land-only path here, AM broadcast signals are very weak or non-existant over a 30 to 60 mile path. My 100 watt 160 meter signal is S9 to S9++ daytime. Yet **W3ASK** in his CQ Magazine column says there is NO POSSIBLE DAYTIME skip on 160 meters. There appears to be room for experimentation. Any thoughts?"

Scott Hedspeth notes that his LowFER beacon **N3S** is off the air, and that he has a new address. "I needed the antenna space for some HF receiving arrays and a planned 2m EME array. My transmitter has been loaned to another ham who hopes to have it running by years' end."

Clint Turner (CT) of Pennsylvania says, "LowFERing out here is different. It was nice (reassuring) to flip on the radio and be able to usually hear **MPM & FAW**, or better yet, drive for a short time and say hi to them! No so here! I guess I could drive 30 miles to the Phillipsburg GWEN site but I would not be welcomed. " Clint will have both his LF and MF beacons in full operation by October 15th. The LF beacon will be 177.750 kHz. The MF beacon at 1624.75 kHz. And Clint is also investigating the possibility of setting up a Part 15 HF beacon as well.

Frank Bauer (W6FPO) who lives in the Santa Cruz mountains reports sadly, "No LowFER activity here for the present. We are surrounded by 80 foot Redwoods and cannot get a signal out with legal power. So I make like a LWL listener. Noise isn't too bad, but at 4 miles my signals are weaker than the San Jose Area signals (**EK, PRK, MEL, SM,** etc.) 30 miles away."

Allan Egleston of Sonora, CA signed up for a years supply of Western Update and says, "I am working for my Novice ticket. This 1750 meters stuff will give me experience in a para-ham environment. My beacon call will be **KAE.**" Allan asked where to go for info about equipment, plans, converters, antennas and such. **Western Update** is a good starter, Allan! Try **Burhans Electronics** for converters and preamps. The **Ken Cornell Scrapbook** is a good general source of LowFER information . Also, be sure to subscribe to the **LOWDOWN**, a publication of the Longwave Club of America (see addresses for these in the last issue of Western Update).

Brice Anderson (BA, Illinois) checked in to report, "Have been very busy with company...our two sons from NM and my sister and husband from TX. No time for any radio work! BA is on the air whenever storms are not too close, however, receiving conditions are very poor this summer, with horrendous QRN day and night. Often, I cannot hear **UPN** or **YHO** for the static. Hope the air clears soon!"

Steve Ratzlaff (Sunnyvale, CA) wrote a fascinating letter about a two-week vacation to Oregon where he had a chance to do lots of listening for "whistlers". He copied **Mike Mideke** (Z2) on the letter, and I'm sure we'll be hearing more on this subject in issues to come.

Mark Mallory (MPM, Salt Lake City) stopped by a couple of weeks ago when he was in this area on business. **MPM** keeps cranking...and is being heard quite well in California.

The **WAVEBOX** photo is courtesy Teledata Systems, 68 Reservoir Road, New Milford, CT 06776, (203) 355-8285. I don't know anything about it, but the accompanying news release claims 10ppm accuracy and stability over its 1Hz to 100 kHz range. Resolution is 1Hz. Sinewave output is variable up to 20 v p-p. Price is (gulp!) $325.

That's it folks! Thanks again for all the contributions. Remember to keep your SASE's up to date. We'll publish again when it makes sense. Have a delightful Autumn!

SPACE PROJECT "ACTIVNYI"

BY

Michael Mideke

Project ACTIVE is a proposed series of geophysical experiments and observations that has been initiated by the Soviet Space Research Institute (IKI). Central to the project are a pair of satellites (ACTIVE and CZACK) which may be placed in low earth orbit by September, 1989. The two satellites will be launched as a single package, with CZACK separating a few days after launch to take up its initial station 1 to 10 km from ACTIVE.

ACTIVE will carry a powerful VLF transmitter and loop antenna. These tools will afford researchers their first opportunity to utilize a space-based source for the triggering of magnetospheric emissions. This approach bypasses significant problems involved with initiating magnetospheric activity from the surface. It also offers new potential for measurement and control; especially with CZACK available as a monitoring platform that is mobile with respect to the source of triggering emissions. Data gathered from the array of ACTIVE experiments (VLF transmission is only one facet of the project) should serve to advance our understanding of whistlers and VLF emissions. This is a step in the development of a detailed picture of the structures and processes of the magnetospheric plasmas that are earth's interface with the deep space environment.

All very interesting (or maybe not so interesting!), but what does this Soviet research project have to do with longwave hobbyists who are mostly located in North America?

If ACTIVE is successful, it will produce triggered emissions (see "Sounds of Natural Radio, Part 2" in THE LOWDOWN). It is quite likely that such emissions could be heard by amateurs using simple broadband receivers similar to those outlined in Part 3 of "Sounds of Natural Radio". If the ACTIVE satellites prove to be functional during a month of testing over the USSR, they will then become available to an international research program which includes up to 10 scientists in the US. In a summary of US experimental plans dating from late 1988, broadband monitoring stations are proposed for Quebec, New Hampshire and New York in the east. Stanford and Los Angeles are proposed for California. ACTIVE transmissions targeting these sites could produce emissions widely audible over much of eastern and western North America. US participation could begin as early as Oct. 1, 1989, with ACTIVE transmissions concluding around March 1, 1990.

Here are a few further details on the experiments, with special thanks to Pat Harrington, who alerted me to this event, and to Dr. Owen Storey of NASA, who was quick to provide supporting literature.

ACTIVE supports a 10 KW transmitter known as VLF-G. It is capable of delivering up to 150 amperes to a 20 meter diameter loop antenna. The loop is composed of ductile aluminum alloy tubing about 1mm thick. It will be lofted in rolled form, then slowly unrolled into a loop from a platform attached to the spacecraft.

9600 Hz is the transmission frequency of choice but the actual operating frequency will be chosen to obtain best loop efficiency. There are 8 possible choices: F_1 = 9000 Hz, F_2 = 9191 Hz, F_3 = 9391 Hz, F_4 = 9600 Hz (nominal) F_5 = 9818 Hz, F_6 = 10,047 Hz, F_7 = 10,286 Hz, F_8 = 10,537 Hz. Stability is not worse than 1 in 10^{-4}.

Three power levels are available. Nominal antenna power is 150 amps. ½ power (106 amps) and ¼ power (75 amps) are also available.

VLF-G has eight programs of emission, each program having a duration of 48 seconds. These programs are described as follows:

I- 0.5 sec. emission, 3.5 sec. pause. There are a total of 12 pulses of emission. Antenna power is nominal.

II- 0.5 sec. emission, 3.5 sec. pause; a total of 12 pulses of emission. Antenna power is nominal for the first 4 pulses, ½ power for the second 4 pulses and ¼ power for the last 4 pulses.

III- 1 sec. emission, 1 sec. pause; a total of 24 emission pulses. Antenna power is nominal.

IV- 1 sec. emission, 1 sec. pause; a total of 24 emission pulses. Antenna power is nominal for the first 8 pulses, ½ for the second 8 and ¼ for the last 8.

V- 4 sec. emission, 12 sec. pause; a total of 3 pulses of emission. Antenna power is nominal.

VI 4 sec. emission, 12 sec pause; a total of 3 pulses of emission. Antenna power is nominal for the first pulse, ½ for the second and ¼ for the third.

VII- 8 sec. emission, 8 sec. pause for a total of 3 pulses of emission. The emission is square-wave amplitude modulated at a frequency of 75 Hz, the peak antenna power is nominal.

VIII- 8 sec. emission, 8 sec. pause for a total of 3 pulses of emission. The emission is square wave modulated at a frequency of 18.75 Hz; peak antenna power is nominal.

Due to battery considerations, these programs can be run for only a limited number of times in succession. The maximum number of consecutive 48 second programs of each type is as follows:

I = 6, II = 7, III = 1, IV = 2, V = 3, VI = 5, VII = 3, VIII = 3

TRIGGERED EMISSIONS- In the event that some or all of the emission programs result in triggered emissions, complex and possibly fairly strong signals will appear above , on and below the transmitted frequency. Such emissions are not likely to exhibit stability of amplitude or frequency but they should bear some temporal relationship to the triggering format. It is important to be aware of the program formats in order to sort ACTIVE triggered emissions from natural background activity.

It is likely that triggered emissions heard on the surface will be stronger than the triggering signals, which are predicted to reach 1 uV/m at best (for high latitude sites directly under the satellite.) Still, given quiet wintertime conditions and a narrowband receiver tuned to the proper frequency, we may have some chance of hearing the direct signal.

Timekeeping is important. If we are to compare reception results or seek confirmation of triggered emissions we should have time pinned down at least to the second. My own approach to this will probably be to split one track of a stereo recording between WWV and a narrowband receiver on ACTIVE's frequency, reserving the second track for broadband receivers.

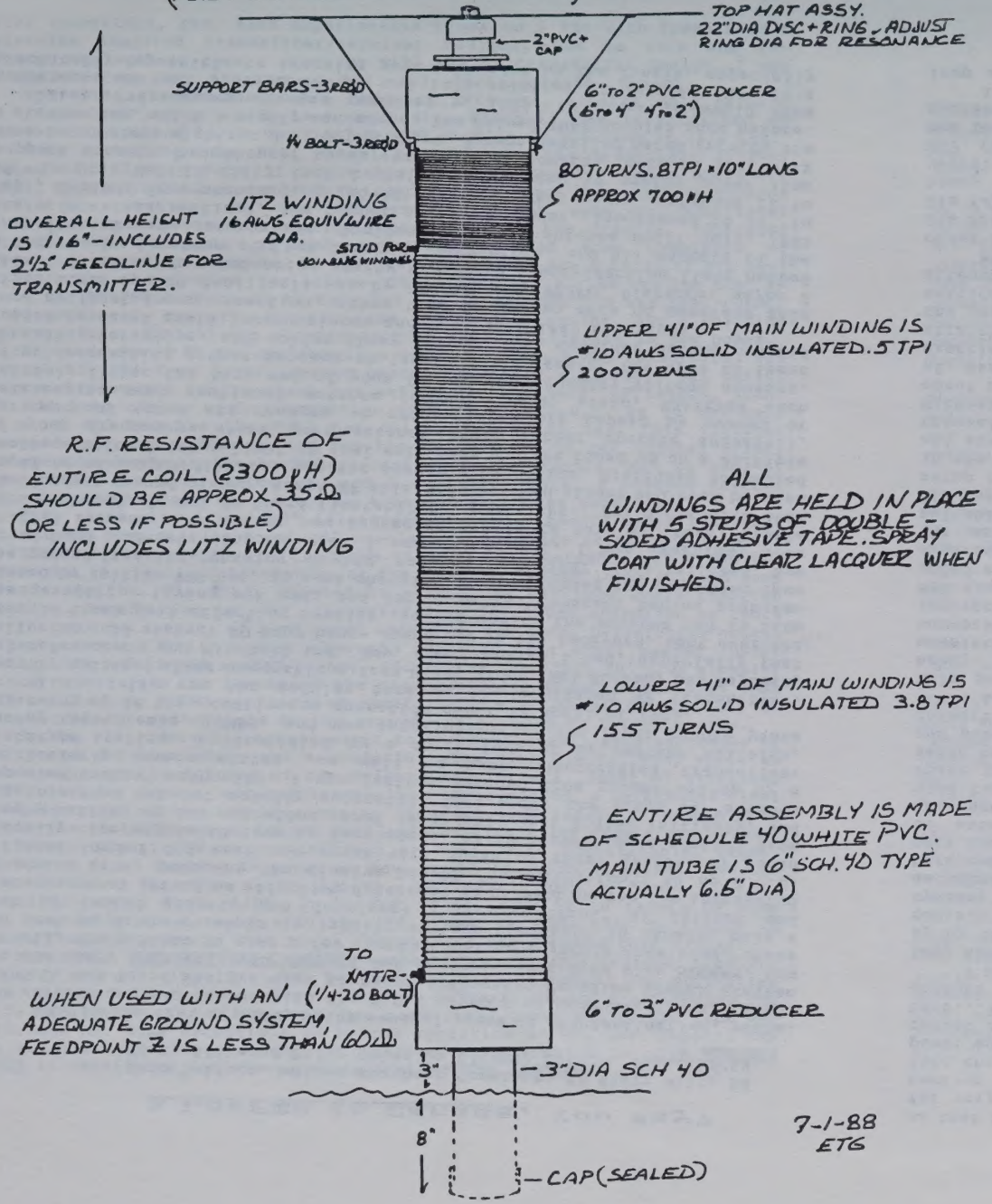
Transmission windows are limited both by ACTIVE's orbit and by the necessity of recharging batteries between sessions. The longest time the satellite will remain in view of any one ground station is about 20 minutes. If we want to attempt to monitor the activity, we really need to know WHEN to listen. This is especially true for that majority of potential listeners who must travel to remote sites to avoid powerline interference. I am presently (Late July) trying to determine how and whether schedule information can be made available. Should this be possible, it is unlikely that there will be time to organize much of a network through THE LOWDOWN or the newsletters, so if you are seriously interested in attempting to monitor ACTIVE experiments, please contact me by mail. Include a business size SASE (don't worry about SASEs if you are outside the US), and let me know ALL ways in which you might be able to pick up timely schedule updates: telephone, online nets, amateur radio, etc. At the moment I can't promise anything at all, but by the time this reaches your mailboxes I should have a much better idea of the possibilities.

Send your info and SASEs to: Michael Mideke, Box 123, San Simeon, CA, 93452-0123.

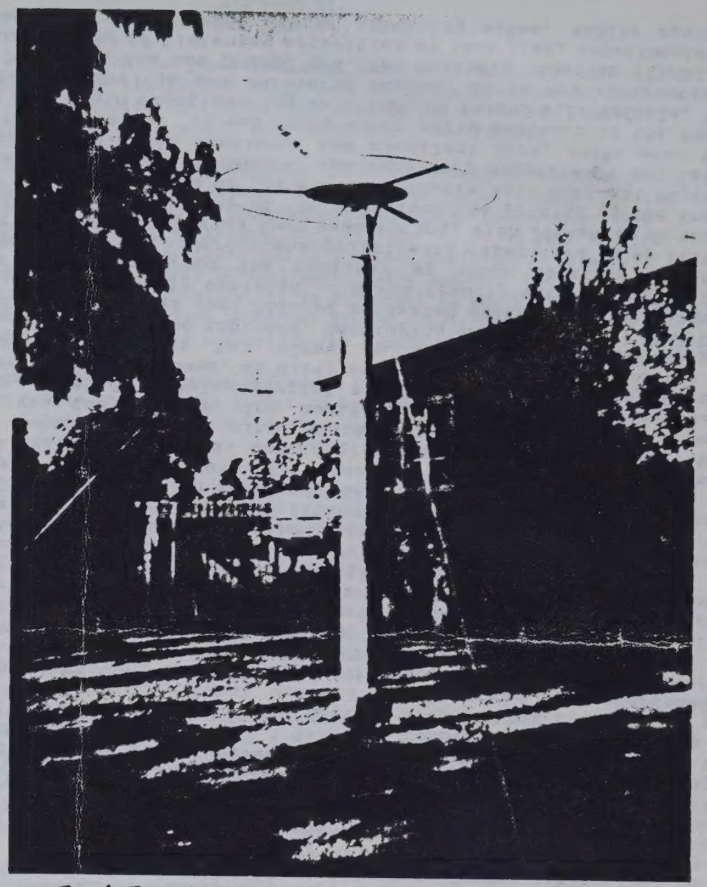
(Ed. note: As of today, September 24, it looks as though project directors will give out schedules, and will welcome experimenter participation.).

3 METER ANTENNA FOR 510 - 550 KHZ

(FOR FCC PART 15 COMPLIANCE) by: Ed Gellnas, Sunnyvale, CA



7-1-88
ETG



ANTENNA Z IS 45 Ω FOR THIS PARTICULAR INSTALLATION
BASE CURRENT IS 32 MA RF

A LowFER In Canada, You Say?

Herb Balfour, editor Northern Observer: 91 Elgin Mills Rd. West; Richmond Hill; Ontario; L4C4M1; Canada. Sept. 11/89.

Back in the fall of 1984, after several years of procrastination, verbal and written confrontations with the D.O.C. (Dep't of Communications, Canada = F.C.C. U.S.A), I was prepared to place a flagship Canadian LowFER station "on the air". This followed support and encouragement from Mike Mideke, Ken Cornell, Vince Pinto to name a few. To the best of anyone's knowledge, there had been no prior attempts to legally attempt operation in Canada, only a list of failed efforts and doubters! This "precedent" of failure and discouragement served as effective deterrant in preventing the few interested Canadians from pursuing the elusive LowFER "authorization". As no D.O.C. official (and I did meet and speak with SLEWS of those gentlemen) could actually cite any solid laws or regs specifically preventing a station from simply setting up and operating, that is exactly what I did, initially, and was tolerated but not solidly supported. This under the wings of "antenna experimentation" authority. I was further impeded from proper set-up by a particularly severe winter, as well as much unsuccessful transmitter prototype testing. I identified by a short form of my amateur callsign, during these tests, (OHH), and was scrutinized for the first couple years following my 24 hrs. continuous operation debut in April of 1985.

I initially ran the modular form of the published VP transmitter, heavily modified after suggestions from Mike, Vince, Hal Murken, Les Rayburn, Sal DeFrancesco and Mitchell Lee. Boy, the troubles I had, especially that following cold winter. SO many hours spent out in the backyard, bent over the plastic trash pail effecting repairs, (after moving the antenna and tx from the garage!), trying out mods and improvements. Constant tuning problems caused by initial VFO use, an ever changing ground problem and de-tuning from the ground freezing, thawing, drying, soaking... VMOSFET final failures, due to minimal understanding of what I was doing. But, I was learning! Some initial lessons : no matter how convenient it is to have exciters, finals etc. socketed, do not do this! (instability, parasites). Build circuits over good copper ground planes, erect RF shielding between stages and even between sections of output filters, monitor possible harmonics, disregard so-called "voltage sticks" (they light up real well when you are tuned up on a multiple of your frequency, where your antenna would rather operate ANYWAYS!), intermittent opens and changes in conductivity are caused by swaged or telescoping mast sectional antenna (solder, weld, strap, WHATEVER such joints), filter the heck out of your DC and AC secondary voltage sources. After determining proper matches on tapped coils, resist the urge to leave the alligator clips, and solder those connections. Consider butane powered solder irons to avoid inconvenience and downright lazy solutions.

My first known reception, other than by my own ears on numerous solo dxpeditions (sound familiar?) was by VE3FAK, now VE3FQ. Distance: maybe 2 miles! Trimming or eliminating nearby trees and power-leeching limbs helped a lot, as my location at that time was very urban, and all aspects of the installation were compromises. Incidentally, the antenna until July, 1985 was a 20' steel vertical, one tophat added in August, lengthened to 30' in Sept, built a free-standing, guyed 30' vertical that month, extended it to 50' in Oct. Had 12 fifty foot tophat wires strung to nearby power line support strands, neighbours' homes, garages and towers. (much of this work done on moonless nights...) From the start, I kept detailed dated records via a station log, which I highly recommend. You solved THAT problem once before.

Several frequency changes resulted in 1985, in order to avoid FEMA powerhouse AM test station WGU20, and it's splatter. I learned that it's practically impossible to oversize your heat sink on the finals, especially as that first year was QRO operation by night, and the tx was really intended for very QRP use. Battery back-up for the programmable keyer, storage cell back-up for the transmitter during power blips and outages were incorporated into the scheme of things. Gave up on toroidal low-pass filters during high power operation, due to heat failures... Maybe larger versions exist, but I cannot locate them... went to air coil tuned by ferrite, now super-ferrite bars...instituted remote switch gear at the antenna site to facilitate power changes and tests. Instructed my wife, and a neighbour on safe shut-downs.

I buried all ground radials after extensive tests, (also, our tiny back-lot, already shared by the dog, garden, etc. could not be tied up indefinitely by above-ground wires!) research and correspondence to determine "best" radials system. I am now convinced an elevated, insulated-wire counterpoise system, with the insulated base of the antenna about 7-10' above ground and an umbrella of insulated ground radials is best (for us, anyhow). Buried, bare radials worst, when coupled with a ground-mounted vertical. You must pick the best compromise between these extremes. Copper tubing feed to base of antenna (after all, we are dealing with skin-effect), strip-line arrangement of transmitter modules; minimizing lead lengths on fets are all good tips. Soldering or welding the tophat/radial connections IS worth it. Spare transmitter sections keep you on the air. Ferrite tuning of antenna match coil at low power levels does make that coil smaller and more compact, and seems to maximize power delivered to the antenna base. (I was a tough convert to this way of thinking...) Seasonal connection to fences help.

A very instrumental and helpful meeting with Eastern LowFERS took place this year ('85) in N.J; without which I would surely have abandoned the hobby. Vince Pinto went on to other pursuits, Hal Murken took over his newsletter. That fall and winter of '85/'86 saw more mods at OHH, as a homebrew transverter from Charlie Faulkner & Dave Curry's plans was built and incorporated. Sadly, still no other converts to the hobby in Canada, thus the SSB function was not overly effective in use, but it did and does work. I added meters for various monitoring functions, namely field strength, final amperage, secondary and primary voltages, RF current at base of antenna, to the main station. Learned valuable lessons re capacitor choices: types suitable for RF, doubling voltage ratings for DC and quadrupling at AC. Discovered Litz wire, but no sources! (at that time) Also, moved the whole setup to the antenna base, save the keyer and "big switch", which remained in the shack. Minimized losses. Buried all lines, which lowered RFI. Bonded all station modules together, also. Started to suspect my VP style modular transmitter was too complex, too modified. This was later verified by Mitchell Lee. (Keep It Simple, Stupid! = K.I.S.S.) That winter, I learned about raising the antenna base, as dirty snow grounded it out, also the error of designing the lowpass too close to the operating frequency was experienced, it burnt up and exploded, destroying entire station. Walt Glazar straightened me out on this one! Removed un-needed antenna coil windings, and the parasitics mysteriously vanished... Mixed results with deploying the tx vertical as an active probe for receive: my urban location or perhaps attenuator pads?Went to polypropylene/polystyrene capacitors in my filters.

My best receptions occurred that same spring, with listeners on the East coast finally hearing OHH! July of '86 witnessed the passing of the torch to Jim Ericson from Mike Mideke of the W. Coast Newsletter. Both Hal Murken and Jim kept the "lines" open to Canada, and were very supportive. Hal left the hobby in Apr. of '87. Jim continues the excellent work, after more than 3 years! The same spring of '86 saw three other radio amateurs in the Toronto, ONT. Canada area begin experimenting on 1750M. Of these, Bill DeCarle, VE3OBE has been the only serious and surviving beacon. He is now re-locating his successful beacon to his new QUEBEC QTH. See Northern Observer #11/12.

I intensified my LF listening activities at this time, experimented with loop antennae, pre-amps, quiet remote listening sites, mobile equipment,

better converters, etc. Also experimented close to 3 khz with **Frank Reid & Speleonics** inspired transmitter/receiver designs. Due to work and re-location, as well as severe problems with the LF transmitter design, I was off the air from Aug. '86 through Apr. '87. Sure listened, though.

Apr.'87 saw the return of a longwire antennae, exciter only version 190.4 khz OHH, and a visit that fall from Mitchell Lee re-vitalized my efforts, culminating in the Nov. '87 MedFER station OH birthing on 1620 khz.

With much help from Bill DeCarle, Canada finally grudgingly allowed (winter of '87/'88) Part 15 style operation by Amateur Radio operators (only), upon application. One year "licence" style operation, with no antenna restrictions, subject to non-interference. Still open to additional privaliges, upon review of applications. At last, the fragile, tolerated operation by a couple of mad experimenters had some semblance of respectability and permanence! To my knowledge, there are a total of six now. Three capable of activity, two active. The winter of '87-'88 saw the best LF beacon and LowFER receptions to date for me, as our new QTH was semi-rural, and comparatively "quiet". Not the case, as of next spring, and a building boom eruption, with all the electronic toys that proliferate in new homes.

May thru Nov. '88 saw continuation of MF efforts, a new LF vertical was built about 300' from house, remote beacon in nearby Willowdale was built, new transmitter and remote shack was set-up for the "new" LF beacon, 3OHH. ("3" added to comply with recognition request from D.O.C. as to ham call status. I did not use the full ham call, as I still feel this violates international regs.) That spring saw the fulfillment of yet another dream, with my attendance at the LowFER convention in California. Met so many of those people who have helped you and I over the years, & enjoyed several personal visits before and after, as time and schedules permitted.

This visit also "inspired" (disagreements understood!) me to resurrect the one year plus missing "eastern" newsletter. Promises of support from all over the U.S. were kept, and continue to this day. December witnessed the return of a re-vitalized LF station at the new QTH. Remote loops allowed even better reception. The QSL's started to resume, as **KRY** once again reported reception. Interesting to note, I hovered from 100-900mW operation on 190.4 khz; the once neccessity of high power operation now gone. Differences noted: shorter antenna (36'!); copper sleeved, soldered over steel swaged insert masting; 12' end-linked spoked tophat, (down from the 12-15 50' plus wires!); antenna remote from the house, in the clear; simpler transmitters used (MEL style exciter or K1RGO synthesised exciter); use of super ferrite bar in antenna coil; ground radials ON the ground, as opposed to buried status.

Spring '89 involved a return visit to the West Coast, more exchanges of experiences and knowledge, and a wonderful stay with Jim Ericson, where we rag-chewed over the futures of our beloved newsletters. June '89 witnessed LF 3OHH down for summer, antenna/transmitter improvements, a switchable final arrangement all set up for this coming "season". OHH remote LF beacon down in July, as that QTH was no longer available or viable for remote operation.

Future plans: OHH re-commissioned as OHH3, more identifiable, legal, etc. Now in final testing sequence at new, north location of Aurora, ONT. To be on 24 hrs. for the winter/spring, at least. 3OHH MF down for new transmitter as of Sept. 1/89. On by Oct. 1/89. 3OHH LF to return by same date, hopefully simul-keyed with the 190.4 beacon. Also plan to engage in antenna comparison tests with power stepping on the MF band this winter.

Meanwhile, **THE NORTHERN OBSERVER** seems to thrive, as a regional specific frequency and activity listings, but non-regional technical and activities forum. A recent issue saw 9 pages of edited letters, we are now pressing the limits of 28 photo-reduction pages per month, and cover activities from 800 Hz through MF. Some exceptions re beacon operation on HF, now. Support has been surprising, gratifying and encouraging. Subscription to **THE WESTERN UPDATE** is considered mandatory, as is that to **THE LOWDOWN**. '73'- *Herb.*

ANTENNAS AND THEIR FEEDING

By: Clint Turner, KA7OEI/3 and CT
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If you have ever covered the gamit of LowFER antenna designs, one can say the interpretations of the regulations range from being conservative to, shall we say, "creative." Nevertheless, my purpose here is not to debate what is kosher and what is not, but rather to give people a few ideas.

It is apparent (to me, at least) that the de-facto "standard" LowFER antenna is the 35 foot vertical topped with a 15 foot radius radial tophat (see fig. A.) This design is a compromise accepted pretty much by conservative AND liberal interpreters of the so-called "50 foot rule" (i.e. 35 foot vertical plus 15 foot tophat equals 50 feet) and is a proven performer. This is probably chosen over the simple 50 foot mast (1)(no tophat - see fig. B.) because of a matter of practicality (it is difficult to erect a 50 foot self-supporting mast!) and that given identical ground conditions, the shorter, tophatted vertical will always outperform the simple mast by several dB.

There are those LowFERs that use a different interpretation of the "50-foot rule." These people consider the tophat to be part of the matching network and not part of the antenna proper therefore are allowed a 50 foot high antenna with whatever sized tophat is appropriate.

Another "unique" interpretation is that offered by Mark Mallory (MPM)(2). The antenna itself (fig. C.) is mounted atop a 35-40 foot grounded tower and it consists of a 15 foot aluminum "Windsurfer" mast with a number of 25-35 foot radials attached. The transmitter and matching network are at base of antenna (which is at the top of the tower!) The tower itself is atop a two-story steel-framed flat-roofed building (the roof itself is asphault-covered steel) and grounded to a main roof beam. The rationale is that since the tower is grounded, it is NOT part of the antenna. That fact that the tower itself DOES radiate is just coincidental. Although this installation is in a "gray area," it is not past reasonable consideration.

Mark's "unusual" antenna system brings to bear an interesting point. He is using an existing (grounded) tower as part of his antenna system (well, his "ground system" is part of his overall antenna system...) and many amateurs have an existing tower that they could probably use as a LowFER antenna of sorts. Either that, or they already have a grounded mast or simply do not wish to go to the trouble to insulate a mast from the ground.

Addressing this, look at figure E (3). It can be shown that this system is electrically equivalent to a top-loaded vertical but with the obvious mechanical advantage that the loading coil is located at the base of the antenna. With this scheme, though, there is the very obvious need for very heavy toploading. If we have insufficient toploading, one can obviously see that this antenna is really more-or-less just a piece of coaxial transmission line with a little or no termination on the end. Assuming that you CAN provide a good radial tophat system, this system is really an attractive alternative for those with existing towers and guy-wire systems. In this case, one could simply bridge a few insulators with inductors of enough reactance to keep them from resonating at HF but still be transparent at LF (fig. D.)

The antenna of figure F is particularly interesting. First, note that unlike familiar LowFER vertical antennas, this antenna is inductive (for electrically short antennas, that is) and its matching network takes on the appearance of one that is needed to for matching of a transmitting loop antenna. At first glance it may appear impractical if you already have a grounded tower set up, that is not necessarily the case. One may simply run a set of "outrigger" wires along the tower and feed them. As you can see, at the top, all wires are simply connected to the top of the tower. An example of an "outrigger" antenna can be seen in Reference 4.

A slight variation appears in figure G. This is essentially a reiteration of figure F. except that slanted wires are used. Figure H. is also another interesting antenna. This configuration more closely resembles the "conventional" LF vertical in that it is capacitive, rather than inductive, as are the antennas in figures F and G. Simply put, you have an "umbrella" of downleads coming down to the bottom of the tower and connected together with a either a wire skirt or, if the transmitter is located at the base of the tower, you have a set of short radials connecting each of the downleads together. As a passing comment, the former method would be preferred because of lower capacitance to ground. At the top of the tower, the radial tophat wires are insulated from the tower and connected together with a skirt and to the downleads. Now, what about the capacitance between the downlead wires and the grounded tower? True, this capacitance may reduce efficiency, but only if an inadequate tophat loading is employed. Furthermore, since you have the downlead wires running parallel to the tower, you are actually shielding the tower from opposing currents induced by the radiated RF from the tophat. Incidentally, it is this effect of opposing currents that cause nearby metal objects (or even things like trees!) to degrade the typical LowFER antenna installation. To be sure, it is a good idea that in the case of the antennas of figures F and G that you have at least 4 symmetrical downleads.

Now how about making use of these ideas in a real-life installation? It is likely that you already have a tower with an amateur antenna or two on it. This can certainly pose some interesting problems when you decide to energize the tower with LF RF, as in the case of figures G and F. In these cases, you could simply disconnect all RF connections completely at the base of the tower when you are running LF (not very practical) or, perhaps, ground the antenna coax shield at the base of the tower and possibly use a highpass filter at that point. In the case of rotor control cables, they could simply be bypassed with capacitors and filtered with some chokes. Of course, none of this may really be desirable or ultimately practical.

Then there is the installation of figure H. This puts relatively little RF on the tower itself and is therefore probably the most attractive. Also, keep in mind the possibility of using existing guy wires as the tophat radials (see figure D.)

Finally, let me throw something out concerning loop antennas. It was pointed out to me by Bill DeCarle that the Canadian LowFER amateur license endorsements limits only the E-field strength of a LowFER signal and not the power or the type of antenna used. Thus, it may be possible to get away with using a loop antenna and larger amounts of power since the measurment of field strength is an E-field measurement and a loop in the near field is primarily an H-field radiator.

Keep in mind that the same thing applies here in the U.S. although the limits are lower (5). Theoretically, it would be perfectly legal here in the U.S. to have a megawatt of power as long as your E-field signal strength does not exceed (2400 uV/M)/F(kHz) at 300 meters. How is this? Well, the provisions of Part 15.112 are completely optional. Therefore, those people who MUST use loops or very small vertical antennas (or ones with poor installation) ought to STRONGLY consider opting for the field strength limits set up in part 15.111. It is entirely possible that you may be able to legally radiate a better signal that way than you could using 15.112!

REFERENCES:
(1) Western Update #41, December 1986, Pg. 5, "Longwave XMTG arials: Year-Long tests," reprint of info. by Art Childs (TYP).
(2) Western Update #53, March 1988, Pg. 4, and personal visits to the MPM beacon site.
(3) Rudge, Milne, Olver, Knight, "The Handbook of Antenna Design", Vols. 1 and 2. (LOC # TK7871.6.H34)
(4) Western Update #56, June 1988. Pg. 2, (See MAILBAG and photos for details on Cliff Buttschardt's "C" beacon)
(5) Western Update #61, December 1988, Pg. 6, (This is a reprint of FCC parts 15.101 through 15.113 concerning unlicensed VLF, LF and MF transmission.)

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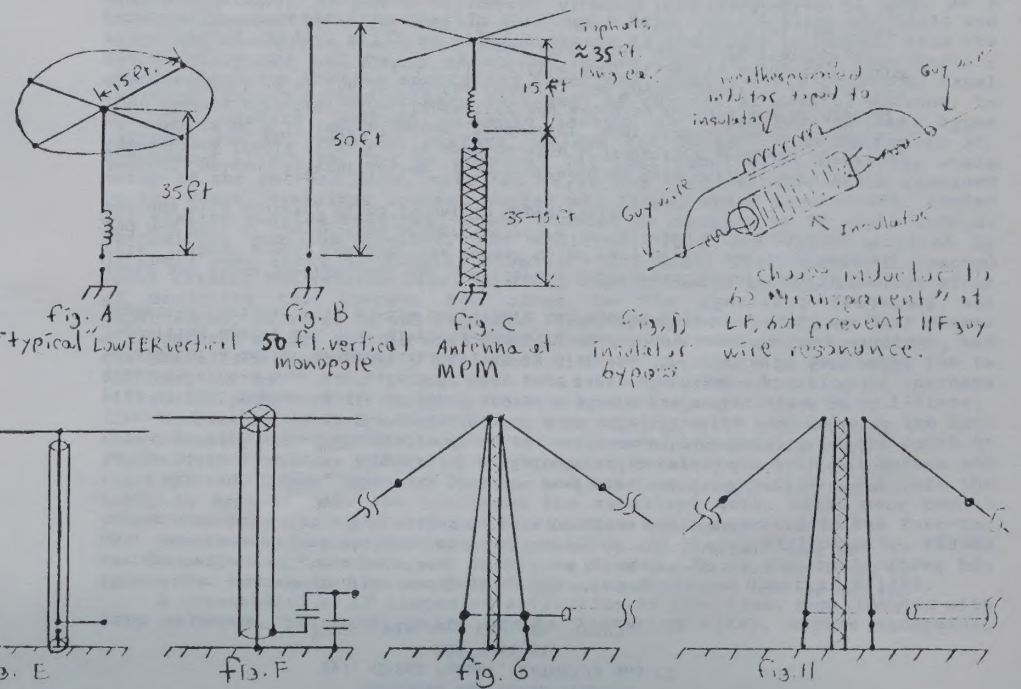

by Max Carter

Those who have been following this series of articles probably have noticed the breathless enthusiasm with which I've described some of the past successes of LowFER BPSK (biphase shift keying) but might be a little irritated that none of the actual receiver circuits have made it to print. Well, let me offer a few lame excuses: 1) The transmitter circuits have been printed. These were designed in the fall and winter of 1985, within a month or two of picking up my first copy of Lowdown, and have not changed substantially since then. I've just recently completed their publication in Lowdown (1,2). Okay, so I'm slow! 2) My receiver has been changed dozens of times since it was first built in the fall of '86, including a completely new receiver in '88. It would have been foolish to spend time painstakingly drawing schematics and writing up discriptions of how they work when they might become obsolete the week after they were printed. And besides, building and testing the stuff is more fun. Would you rather I had waited until LowFER BPSK was cast in cement before I had submitted it to Bill O., say around the year 1995? 3) I have sent sloppy copies of the circuits without explanation to a lot of readers, but, I think, judging by the poor response from those who have received the prints, that most simply say - "I can't hack this!", and lose interest. In this age of sophisticated, yet cheap, off-the-shelf equipment, has the modern day radio enthusiast lost his ability to build anything more complicated that a code practice oscillator? 4) Last, but not least, it's been my intention to keep the BPSK pot simmering in order to keep the interest of the readership; not only for those who might someday make use of this interesting mode but, specifically, to challenge those out there who might have greater engineering ability than I to take up the pursuit.

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In this last endeavor I've been somewhat successful. I still dabble in LowFER BPSK, but the real hotbed of activity has shifted west; to Utah. Utah LowFERs Chris Spencer (FAW) and Dale Jarvis, as well as ex-Utahan Clint Turner (CT, now living in PA) are all BPSK enthusiasts.

Most of the interesting work lately has been by Mark Mallory of Salt Lake City. He recently demonstrated his impressive new receiver to me while he was on vacation in Wyo. during July. He told me how surprised he had been when he copied my BPSK beacon (MAX, Wheatland, WY) from SLC around noon a few days earlier, a distance of 375 air miles. He was demonstrating the receiver to his friend, Ron Jones, on their lunch break in the parking lot where Ron works. Mark switched the RX to 175.225 and began talking to Ron about something else. Then he happened to notice the "lock" LED on the RX was out, indicating the RX had acquired a carrier. Sure enough, MAX's began appearing on his readout screen. What was so exciting was that he could not detect the presence of the signal aurally! his RX was pulling the sig. up out of the noise! (as theory suggests it should be able to do). He knew then he had a successful design.

The new RX, which works with 800 Hz audio from a conventional receiver, uses a combination of analog and digital techniques. Mark has stuffed it into a nice, neat little package, much smaller than my RX. When he demonstrated it to me, I was quite impressed.

The receiver displays the received message on a 32 character LCD display, or can drive a printer via a standard parallel interfaced output or 1200 baud serial interfaced output. The display is driven by a DB748HD microcomputer (has on-board EPROM) which accepts raw serial data and recovered bit clock from the receiver's final data/clock recovery circuits and automatically extracts the biphase NRZ data, performs the necessary NRZ-M to NRZ-L conversion, and - especially interesting - finds the character framing bits (the start and stop bits). This last function uses a "filter" algorithm which, in effect, allows the asynchronous format BPSK signal to be decoded synchronously. (It should be noted that this is possible only because of the "asynchronous format, transmitted synchronously" nature of a standard LowFER BPSK signal.) This results in a lowering of the noise content of the final displayed (or printed) data. My receiver, by contrast, has both asynchronous and synchronous modes, but in order to use synchronous mode, a minimum of two or three "known good" characters must be received in asynchronous mode before switching to synchronous mode. Mark's design makes it all hastle free! Mark generously offered to burn his program into an 8748 for me and even donated a spare 32 character LCD display! I intend to incorporate his display into my receiver.

The actual receiver portion of Mark's design (should we call it Mark's Mark I?) uses an elegant "Costas Loop" circuit for both carrier recovery and bit clock recovery. For those interested, carrier recovery is the most important function (and design challenge) of any BPSK receiver. As mentioned, it is implimented using both digital and analog techniques. I won't go further into how it works except to say that it works very well.

And how does it compare to my receiver? Well, we never got around to a side-by-side comparison. Those familiar with typical summertime noise levels encountered at various times of the day on 1750 m can appreciate this: Mark arrived here around 12:30 PM and immediately turned on the receiver in his truck and tuned to 179.000 (MPM, Salt Lake City, 375 air miles away). Soon the RX was outputing a steady stream of MPMs, missing only occasional characters. GWEN (groundwave emergency network) came up a few times wiping out most but not all of the characters. This is comparable to what my receiver does at that time of day receiving the same signal. My wife called us to lunch and, after eating lunch, touring the MAX site and cussing and discussing various LowFER subjects, we got back to the receiver about 3:30 PM. By that time the static on the band had increased substantially with crashes of 50-60 db over the noise floor. Under these conditions, Mark's receiver was unable to establish carrier lock (for any substantial length of time, anyway) but was able to produce an occasional "MP" or "PM". Again, similar to how my receiver performs at that time of day on the same signal. So, I would say the performance of Mark's receiver at least matches that of mine. Considering that this was the first time out for the receiver, a very impressive showing indeed. Knowing Mark's considerable engineering talent, if it ever did come to a showdown, my receiver would probably go down in flames.

(I should throw in some more breathless enthusiasm here: We're talkin' here about copying a 1 watt LowFER 375 miles away! Not "skip". Not "daytime enhancement". Just plain old everyday groundwaves!)

Aside from its impressive performance, I think one of the main advantages of the new receiver is its relative simplicity. When Mark was here we talked about the possibility of making circuit boards and a kit of parts available to other LowFERS who would like to experiment in this mode. We decided not to pursue that since Mark considers his present receiver to be only an experimental stepping-stone to an all-digital design consisting basically of a moderately high resolution (say, 8 bit) analog to digital converter followed by one or more microprocessors followed by an output device. He envisions an all-purpose receiver usable in BPSK/ASCII, BPSK/Morse, MSK (minimum shift keying) and CCW (coherent CW) modes. Physically, it would be much simpler even than his present receiver. Such a design could truly bring BPSK to the masses!

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So, where does that leave BPSK circuits in Lowdown? Well, given the relative simplicity of the latest RX, I probably won't pursue a complete write-up of my circuits. I may write something general on how BPSK signals are received and, since I absolutely reject the idea that one must have a $900 general-coverage receiver or a $1200 ham transceiver to participate in this hobby, may develop a simple "front end" - a longwave radio receiver with an 800 Hz audio output - to be used ahead of a BPSK receiver. Of one thing you can be sure, I will continue to report developments as they happen. - Max

Ref:

1) "A BPSK/ASCII LowFER Beacon Excitor", The Lowdown, Nov., '88

2) "Put Your Computer on the Air", The Lowdown, May, '89

July 23, 1989

Hi Jim,

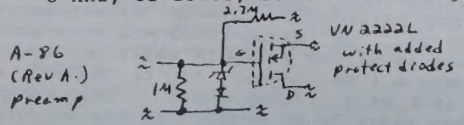
In recent correspondence with Ralph Burhans, he helped me with Loran-C interference on my active whip when listening at Elgin, Or. He also mentioned some improvements to his circuits and some other information. He mentioned I might want to pass some of it to you for possible inclusion in the Western Update, so here's the stuff.

1. In recent correspondence with Ralph Burhans I said I had severe intermodulation distortion from the strong 100 kHz Loran-C station in George, WA. from my listening site in Oregon. He was kind enough to send me an A-86, Rev. A, Whip Preamplifier, custom-designed with the first input trap tuned to 100 kHz, to notch out the strong station and thus reduce the intermodulation distortion. Anyone experiencing similar problems should contact Ralph. (On my last trip to Oregon I somehow left the active whip here in California so didn't get to try it out, but checks on the bench at work showed over a 20 dB notching of the 100 kHz signal--quite a reduction from a single tuned circuit.)

2. The A-86, Rev. A, Whip Preamp has an improved feature when used with VN2222L VMOS transistors which have built-in negative limiting diodes on the gate. Ralph has added an extra silicon diode plus zener diode combination which limits the positive excursion of the gate to +5V. or so--thus the circuit limits for both plus and minus 5V. amplitudes at the gate. This helps in lightning-induced surge problems where the neon bulb may not protect the circuit completely. Other VMOS, like the BS170 or the 2N7000 do not have the input limiting diode internally so a second pair of diodes would be required. The silicon diode is necessary to reduce the input capacitance of the zener diode.

3. I tried building my own H-90 Loop Preamplifier (see The LOWDOWN, 3/89, p. 16), and used a 600:600 ohm input transformer, but had very poor sensitivity. Ralph explained that this should be the case (!) as the circuit was designed for a 48:50 ohm (essentially 1:1 ratio) centertapped transformer. My advice is to purchase the preamp kit from Ralph with all the correct components already gathered together for you rather than try to "roll your own"!

4. On the RC-86 Receiver Coupler, used with all A-86 and H-86 and H-90 preamps, the series coupling capacitor (0.22 uf) can be increased in value to 1 uf or more if response down to 8 kHz, or lower, is desired. Anyone experimenting with using

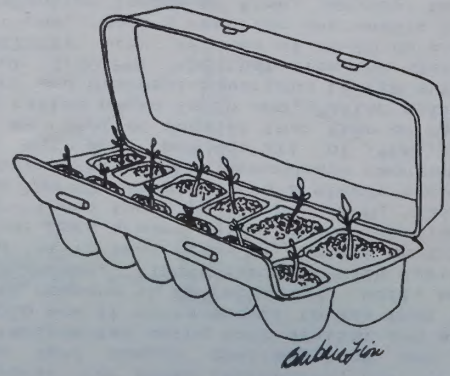


their active whip for audio frequency whistler listening might keep this in mind.

OK, Jim, that's all the stuff Ralph mentioned. Incidentally, I just got this Brother word processor several days ago and am learning to use it. So far I like it fine except the letter quality printer has only one speed--SLOW; a faster rough-draft speed would be nice. If you know anyplace we could drive within maybe 1 or 2 hours max. to find a spot away from power lines to set up my big whistler loop for some listening, let me know. I haven't come up with anything yet. I believe I heard you mention on a Lofer net that you bought a Marantz portable hi-fi stereo recorder. When I got back from the last Oregon trip with the miserable attempts at recording whistlers, I looked up an old ad from EEB where I found they carried the Marantz recorders. I called them and ordered their cheapest model, the PMD-201, which is mono, no third head, for "only" $250. I haven't tried recording with it yet, but it sure is a fine quality unit otherwise, tho it sucks up power from batteries.

See you.

Steve Ratzlaff



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Baker	Brad			21024 Bear Creek Road	Los Gatos	CA	95030
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Chaplin	Carl		W7Q0	Box 2800	Minden	NV	89423
Chappell	Vernon			4511 - 36th Street #6	San Diego	CA	92116
Coote	James	J	WB6AAM	808 North Ave. 66	Los Angeles	CA	90042 (213)258-7490
Cornell	Ken		W2IMB	225 Baltimore Avenue	Pt. Pleasant Beach	NJ	08742
Costa	Bob		KB6QXM	P.O. Box 600	Redwood Estates	CA	95044 (408)353-3656
Cripe	David			7908 Wellesley Court	Pasadena	MD	21122
Curry	David	PLI	WD4PLI	852 N. Lima Street	Burbank	CA	91505 (818)846-0617
Cutter	Robert	CO	KI0G	701 19th Street	Glenwood Springs	CO	81601
DeVaughn	Bob	NBD	K3NBD	829 Estella Street	Pittsburgh	PA	15210 (412)488-1479
Dorman	Mike			15635 21st Ave. SW	Seattle	WA	98166 (206)246-3796
Egleston	A.			20601 Resort Road	Sonora	CA	95370 (209)532-7111
Ericson	Jim	EK	KG6EK	226 Charles Street	Sunnyvale	CA	94086-6063 (408)773-8947
Farkas	Greg	AZ	AK7Y	PO Box 17074	Tucson	AZ	85731-7074 (602)749-4796
Farnsworth	Charles			506 Rutledge Drive	Lodi	CA	95240
Faulkner	Charles	FPV	W6FPV	15844 McKeever	Granada Hills	CA	91344 (818)366-6210
Fisher	Montie		WA5TSL	808 Brett Drive	Edmond	OK	73013
Forsman	Stan			1312 Burrows Road	Campbell	CA	95008 (408)374-2129
Fornek	Stan		K9IXC	640A Rance Road	Oswego	IL	60543
Gelinas	Ed	T (dashes)	WA6AJY	557 N. Bayview	Sunnyvale	CA	94086
Gosenca	Michael			203 Cherry St.	Eaton Rapids	MI	48827
Grater	Jim			1136 S. Johnson St.	Lakewood	CO	80226-5113
Hedspeth	Scott	N3S	WB4YZA	Route 4, Box 227	Mocksville	NC	27028 (704)284-4021
Helms	Bernard			4210-1 Walnut	Berrien Springs	MI	49103
Herr	George			6690 Vista Del Mar #1	Playa Del Rey	CA	90293
Holland	David	DCH	K3YAY	300 South Main Street	Berlin	MD	21811
Hooper	William		KF6AR	366 S. El Monte Road	Los Altos	CA	94022
Hoopes	John			1084-B Sergeants Drive	Robins AFB	GA	31098
Horton	Bob	MSG	W6MSG	2 Fresno Street	Paso Robles	CA	93446 (805)238-2250
Johnson	Dave			PO Box 389	Gainesville	FL	32602
Johnson	Dave	F		713 Texas Ave.	Los Banos	CA	93635 (209)826-0841
Johnson	David		WB7ACG	PO Box 15646	Rochester	NY	14615-0646 (716)235-1104
Johnson	Don	AU	W9TIF	3304 Roxford	Champaign	IL	61821 (217)398-4020
Jones	Ron		K7RJ	9241 S. Toni Lee Circle	West Jordan	UT	84088 (801)561-2685
Jones	Wallie	WJ	W6SZQ	9090 Nagle Ave.	Arleta	CA	91331 (818)892-0552
Kassel	Charles			114 Church Drive	Mastic Beach	NY	11951
Keeley	Roy		KC4IMC	Route 3, Box 316 Salt Air Rd.	Theodore	AL	36582 (205)973-2516
Keller	Eb			2984 Fallwood Lane	San Jose	CA	95132 (408)263-6229
Kincaid	Nilan		W6EIG	5529 W. 140th Street	Hawthorne	CA	90250 (213)643-5269
Kraus	Howard	K2UD		372 Callodine Avenue	Amherst	NY	14226
LaGrua	Michael			Box 549	Caspran	MI	49915-0549

Layer	Hal		N6SPD	PO Box 27676	San Francisco	CA	94127	(415)661-6958
Lee	Mitchell	MEL	KB6FPW	172 North 24th Street	San Jose	CA	95116	(408)298-3026
Lehrbaum	Rick		AC1I	3275 Stockton Place	Palo Alto	CA	94303	
Leonardelli	John		VE3IPS	Box 722, Station A	Downsview (Canada)	ONT	M3M3A9	(416)636-3300
Lingwall	John			PO 70, 1025 Trinidad	Calhan	CO	80808	
Mallory	Mark	MPM	WB7CAK	5196 Cobblecreek Road #7K	Salt Lake City	UT	84117	
Manley	Dean		KH6B	2058 Ainaola Drive	Hilo	HI	96720-3638	(808)959-8257
Marshall	Dave			440 Larry Drive	Florissant	MO	63033	
Martin	Steve		NK3R	141 Bridgecreek Drive	Goose Creek	SC	29445	(803)797-3143
Mawhinney	Scott	T (dashes)		295 Pettis Avenue	Mountain View	CA	94041	(415)960-1041
Maxwell	James		W6CF	PO Box 473	Redwood Estates	CA	95044	(408)353-2094
McGreevy	Steve	SS, SA, TLX	N6NKS	PO Box 2094	Pahoa	HI	96778	(808)966-6946
Mideke	Mike	Z2	WB6EER	Box 123	San Simeon	CA	93452	
Morgan	Robert		KA0FTA	2817 West St. Anne	Rapid City	SD	57702	
Mussler	Mike			Bonanza Star Route	Nederland	CO	80466	
Nickerson	Rick	R	KB6JQU	3224 Saxonville Way	Sacramento	CA	95842	(916)348-1466
Olson	Keith	7FS	W7FS	E. 15470 Highway 106	Belfair	WA	98528	(206)275-2560
Osterud	Jim			519 Capri Circle	Tooele	UT	84074	
Otacilio P. de Sousa	Jose`			Rua Calisto 62, Recanto dos Vinhais	Sao Luis, MA, Brasil, PR8BNP			65070
Owens	James	Q	NW00	1363 Tipperary	Boulder	CO	80303	
Paschal	Ev			Sinclair Island	Anacortes	WA	98221	(206)293-8176
Pelmulder	Jim		N6PTM	2801 Gravenstein Highway	Sebastopol	CA	95472	
Pepe	Bill		WA2TDR	Box 1915	Bloomfield	NJ	07003	
Peterson	Art			851 31st Street	Richmond	CA	94804	(415)234-2014
Phillips	Ed	IZJ	W6IZJ	408 North Alabama Street	San Gabriel	CA	91775	(818)285-8308
Pomer	Zvi		4X1KT	5703 Caminito Norte	LaJolla	CA	92037	
Pomplun	Don		K2BIO	521 Van Buren Place	San Ramon	CA	94583	(415)829-7648
Post	Kendall			1842 Hoffman Street	Madison	WI	53704	(608)244-0500
Raney	David	UPN	WC8E	4128 Linden Avenue	Cincinnati	OH	45236	(513)791-0740
Rappold	Sam	ZYK	WB6ZYK	PO 1267/479 Briceland Road	Redway	CA	95560	
Ratzlaff	Steve	SR	AA7U	900 Henderson / 60A	Sunnyvale	CA	94086-9059	(408)248-0343
Raven	Gregory	TEXAS	KF5N	4550 Sunnybank Court	Fort Worth	TX	76137	(817)485-6771
Reid	Frank		W9MKV	Box 5283	Bloomington	IN	47407-5283	
Remington	Sheldon	HO	NI6E	PO Box 2094	Pahoa	HI	96778	(808)966-6946
Roberts	Todd	ABC	WD4NGG	PO Box 21413	Hilton Head Island	SC	29925	(803)681-8114
Schick	D.H.			580 N. Buena Vista Dr.	Lake Alfred	FL	33850	
Seabury	Tom			PO 535	Diablo	CO	94528	
Seamons	John	JKS	KF6VO	95 Holstein Road	San Anselmo	CA	94960	(415)456-6090
Seden	Randy	ELU	WD6ELU	1272 Harold Avenue	Simi Valley	CA	93065	(805)583-5687
Skillin	Boyd	B	K6MGX	3876 East Pico	Fresno	CA	93726	(209)222-0275
Smith	Glen		N6CX	220 Laurel, POB 475	Kenwood	CA	95452	
Smith	Randy			19515 Frederick Rd. #135	Germantown	MD	20874	
Snow	John		N6AMZ	3708 Judah Street	San Francisco	CA	94122-1227	
Spaulding	Fred		K1YQP	883 San Simeon Drive	Mountain View	CA	94043	(415)961-5018
Spencer	Chris	FAW	WB7FAW	722 West 1850th North	Orem	UT	84057	(801)225-7852
Statom	Mike			1604 S. Campbell Avenue	Alhambra	CA	91803	(818)289-7170
Stewart	Don			2617 Anza Street	Bakersfield	CA	93305-3109	(805)871-7024
Sullivan	John			2069 Touraine Lane	Half Moon Bay	CA	94019	
Taylor	Al			112 Cook Road	Whitehorn	CA	95489	(707)986-7775
Taylor	Bill			327 Camino Del Campo	Redondo Beach	CA	90277	(714)378-5628
Thompson	Arliss	XU	W7XU	Route 1, Box 52	Colton	SD	57018	(605)446-3687
Tracy	John		WB7AMC	10431 Miller Ave.	Cupertino	CA	95014	(408)257-9585
Turner	Clint	CT	KA7OEI	145 West Street	Pleasant Gap	PA	16823	(814)359-2663
Vanderbeek	Herb	G, V, 8-dits	WY6G	630 Ashton Avenue	Palo Alto	CA	94306	(415)493-1726
Vandermaaten	Jim	SM	WB6QZL	1276 Tourney Drive	San Jose	CA	95131	(408)258-6872
Waldsmith	Gary	SUK	K4SUK	1441 Hound Hollow Road	Pilot Hill	CA	95664	(916)933-3815
Weiss	Jim		W9ZMV	c/o Radio WTAQ	LaGrange	IL	60525	(312)579-9104
Welch	James		KK6N	3071 Mauricia Avenue	Santa Clara	CA	95051	
Wilson	Rex	TI	KB7TI	4550 Vernetti Lane	Kingman	AZ	86401	(602)757-3649
Wright	Rick	1SUN	KA5YWH	Box 4181, Station A, SEOSU	Durant	OK	74701	(405)924-3699
Wyatt	Frank		N6FW	855 Ticonderoga Drive	Sunnyvale	CA	94087	(408)737-8155